

The Pauropoda and Symphyla
of the Geneva Museum I.
A synopsis of the genus *Gravieripus*
(Myriapoda, Pauropoda, Eurypauropodidae)

by

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With 7 figures

I. PRESENTATION AND DEFINITION OF THE GENUS

The first species of *Gravieripus* was collected from Carinthia (between Klagenfurt and Wörthersee) and was described in 1884 by LATZEL s.n. *Eurypauropus spinosus* Ryder. However, LATZEL's specimens differed from Ryder's in some basic characters and the former's misidentification led to COOK's description in 1896 of a new species, *E. latzeli*. The species got a new specific epithet but was still thought to be in the original genus. In 1937, REMY then erected the genus *Gravieripus* to separate COOK's species which had 5-jointed legs from *Eurypauropus* and *Trachypauropus* both with first and last pair of legs 5-jointed, intervening pairs 6-jointed. But *Gravieripus* is not alone in having all the legs 5-jointed, so have two more genera, *Samarangopus* and *Australopauropus*, both extra-european and described by VERHOEFF (1934) and BAGNALL (1935) respectively. The latter seems to be a synonym for the former.

The new genus was distinguished from the two last mentioned ones in the following respects:

1. its sternal antennal branch was shorter along its posterior than along its anterior margin (the reverse in *S.* and *A.*);

2. its anterior flagellum of the sternal antennal branch was longer than the posterior one (shorter than in *S.* and *A.*);
3. the stalk of its antennal globulus g_2 was at least twice longer than the diameter of the organ (shorter than in *S.* and *A.*);
4. its tarsi had all a sternal seta (none in *S.* and *A.*).

It might be discussed if all these features are appropriate for a useful distinction of groups on the generic level. Remy's first character, the shape of the sternal antennal branch, is good because it is easily detectable and stable. The second one, the proportion in length between the flagella of the sternal antennal branch, seems to be valuable too but mainly only theoretically because it does not serve well in practice. This because it is often difficult to measure the length of these thin and mostly curved or folded structures. Like the third character, the length/width proportion of the antennal globulus g_2 , it is also quantitative and for that reason a future doubtfulness may arise about its value for characterizing a genus. The fourth criterion seems to be morphologically justified and also practically useful.

II. PREVIOUS SPECIES AND MATERIAL

When REMY erected the genus only *G. latzeli* was known and the genus has always been considered to lack in variety because *latzeli* had a restricted European distribution (p. 616-617) and only two more species have been found during 90 years, one American and one European. It seems now surprising that REMY's intensive studies during more than 30 years did not reveal more than a single new species. The reason is that REMY collected manually and these Pauropoda are difficult to gather in that way because they are rare and slow-moving and also because they mimic soil particles in colour and markings. Representatives of the genus were available only from surface soil layers and in very limited number. Among them however REMY found some specimens from Greece which he referred to a new species, *atticus* (REMY, 1961). Besides only one species has been described from 1884 till now, *armatus* from North America (MACSWAIN and LANHAM, 1948). The former was taxonomically very close to *latzeli*, the latter more separate.

The paucity of species may be seeming because an examination of some specimens from Middle and South Europe and Minor Asia which were sent to me for identification has shown that some new species are involved. These species are described below. Two of them were collected in Spain by A. Comellini, Geneva, and a third in Germany by Dr. S. Husmann, Schlitz. Paratype specimens of one of the Spanish species have been collected in Turkey by Dr. Cl. Besuchet and of the German species in Switzerland by A. Comellini and Dr. Cl. Besuchet.

Some new localities for *G. latzeli* from Switzerland are also reported. The genus was not previously known from the four countries mentioned.

Thus there are now six *Gravieripus* species but in spite of the present contribution the knowledge of the genus is limited. Consequently it is not possible to even speculate on the real number of species or on the evolutionary history before much more material has been collected.

All species are easily identified by a row of good characters. Besides those oftenmost used in taxonomical studies of pauropods there are a number of characters which are particularly useful in differentiating species in this genus. The form of the setose protuberances of the tergites and the shape of the cuticle are both very valuable. Those tergites mainly used in the descriptions below are the second, fourth and sixth, chiefly their posterolateral parts. The legs also offer good characters. Most serviceable is the shape of the setae of the coxa and the trochanter but the setae of the tarsus and the structure of the cuticle can also be utilized. Since the pygidial setae are of many various kinds they too are more helpful here than in most other genera.

III. KEY TO SPECIES

1. Axes of T_3 widened distally; anal plate with at least 4 posterior branches . 2
 — Axes of T_3 not widened distally; anal plate with 2 posterior branches
 1. *armatus* MacSwain and Lanham
2. Submedian branches of anal plate simple, clavate; posteromarginal setae of 2nd tergite broad, flattened. 3
 — Submedian branches of anal plate subcylindrical and with leaf- or bladder-shaped distal appendages; posteromarginal setae of 2nd tergite pointed distally 4
3. Tarsus of 9th leg with one sternal seta; pygidial setae a_1 hooke-like, undulated; b_1 and b_2 tapering distally. 5. *asper* n. sp.
 — Tarsus of 9th leg with two sternal setae; pygidial setae a_1 spinous, smooth; b_1 and b_2 subcylindrical 6. *hispanicus* n. sp.
4. Distal anal plate appendages bladder-shaped, blunt; pygidial setae a_2 thick, widened; a_3 blunt 5
 — Distal anal plate appendages obliquely heart-shaped, pointed; pygidial setae a_2 thin, cylindrical; a_3 pointed 4. *cordatus* n. sp.

5. Globulus g_2 only a little longer than wide; setae of sternal side of lateral margins of tergites subcylindrical, pointed; inner setae of tergites at least partly lanceolate, winged¹ 3. *atticus* Remy
- Globulus g_2 about 3 times as long as wide; setae of sternal side of lateral margins of tergites lanceolate; inner setae of tergites not winged
 2. *latzeli* (Cook)

IV. A SURVEY OF THE SPECIES

1. *Gravieripus armatus* MacSwain and Lanham, 1948

Pan-Pacif. Ent., 24, 2: 80-84, pl. II, fig. 2.

Taxonomical remarks. There are reasons indicating that this American species is distinctly beside the European ones. The latter consist of a uniform group showing a striking homogeneity as to several morphological characters which deviate from those in the former.

Distribution. So far reported only from two localities, both in California. MACSWAIN and LANHAM gathered there on a slope of Mount Diablo in Contra Costa County and in Redwood Regional Park near Oakland in Alameda County. They found 23 specimens, 9 adults and 14 juveniles.

2. *Gravieripus latzeli* (Cook, 1896)

Brandtia, 6: 31-32. New York.

Synonyms: *Eurypauropus spinosus* Latzel, 1884 (non Ryder, 1879)

E. latzeli Cook, 1896

E. ? Latzelii: Hansen, 1902

E. Hansenii Silvestri, 1902

E. (Eurypauropus) latzelii: Verhoeff, 1934

Gravieripus Latzeli: Remy, 1937

Gravierypus latzeli: Chalupský, 1967

This species, the type of the genus, was the first *Gravieripus* to be described. Its diagnosis is best given by REMY (1937: 25-32, figs. 17-21).

Distribution. Switzerland, Schaffhausen, Merishauser, among dead leaves, 1 ad. 9² (♂), 1965-09-07, leg. Besuchet; Fribourg, Broc, 1 ad. 9 (♀), 1962-07-10,

¹ There are also pygidial characters separating *atticus* and *latzeli* but they can not be established without a fresh study of REMY's type specimens of *atticus* because some markings in the drawings of the type description (1937: 177, fig. 6 and 7) and the information of the legend of the figures are inconsistent.

² Abbreviations: ad. . . . and subad. . . ., an adult or a subadult specimen with the number of pairs of legs indicated.

leg. Comellini; Geneva, Veyrier, at the base of an old decaying stump, 3 ad. 9 (1 ♂, 2 ♀♀), 1 subad. 8 (♀), 1968-09-27, leg. Besuchet.

The species has not previously been reported from Switzerland. It is rare but widely distributed in the southern half of Europe. The known range is composed of parts of the following geographical areas: in France, Ain (REMY, 1947) and Côte-d'Or (REMY, 1961a); in Italy, Liguria (SILVESTRI, 1902; HANSEN, 1902) and Venezia (REMY, 1962); in Austria, Higher Austria (ATTEMS, 1949), Carinthia (LATZEL, 1884; REMY, 1937), Styria (SCHUSTER, 1960) and Lower Austria (ATTEMS, 1954; SCHUSTER, 1960); in Czechoslovakia, Bohemia (STORKÁN, 1940; CHALUPSKÝ, 1967); in Yugoslavia, (DIZDAREVIĆ 1971, 1973); Bosnia (ATTEMS, 1959)¹; and in Roumania, Transylvania (REMY, 1937, 1939, 1942) and Walachia (REMY, 1937).

No other Eurypaupodidae species has been found in caves.

3. *Gravieripus atticus* Remy, 1961b

Annls Spéléol., 16: 177-178, figs. 1-7.

Taxonomical remarks. The species is very close to *latzeli* from which it is distinguished by a shorter globulus g_2 of the third antennal joint, different shape of both lateral and inner setae of the tergites and also some pygidial characters.

The separating of *atticus* from *latzeli* may be admitting of discussion because the two species have most characters in common. Apparently the general chaetotaxy and the anal plates are identical. Moreover the Austrian *latzeli* specimens reported by SCHUSTER (1960) are intermediate because their globuli g_2 are short like in *atticus* and because the tergal setae show characters of both species.

Distribution. Not known outside the type locality in Greece, Keratea 1 in Attica, from where 9 specimens were collected at bases of fig-trees.

4. *Gravieripus cordatus* n. sp. (figs. 1-2)

Material examined. 9 specimens.

Holotype. One of the adult females from Spain. Data: See below under Distribution. The type specimens are in the collections of the Natural History Museum, Geneva.

Colour. Dark brown.

¹ The marking for Hercegovina in ATTEM's table on the distribution of the cave-dwelling Myriapoda of the Balkan Peninsula (p. 298) seems dubious because he later records the species from Bosnia only, both (p. 319) in the list of the species and (p. 397) in the list of the caves. In all probability the record from Hercegovina is in error.

Length. (0.94-) 1.23 (-1.30) mm. Average length of adult specimens 1.11 mm. Greatest breadth (3rd tergite) (0.40-) 0.48 mm.

Antennae. Globulus g_2 of tergal side of 3rd joint (1.3-) 1.4 (-1.8) times as long as broad; its bracts are open and its cuticle pubescent. Relative lengths of setae of 4th joint: $p = 100$, $p' = (95-) 100-110$ (-113), $p'' = (75-) 91-100$, $r =$

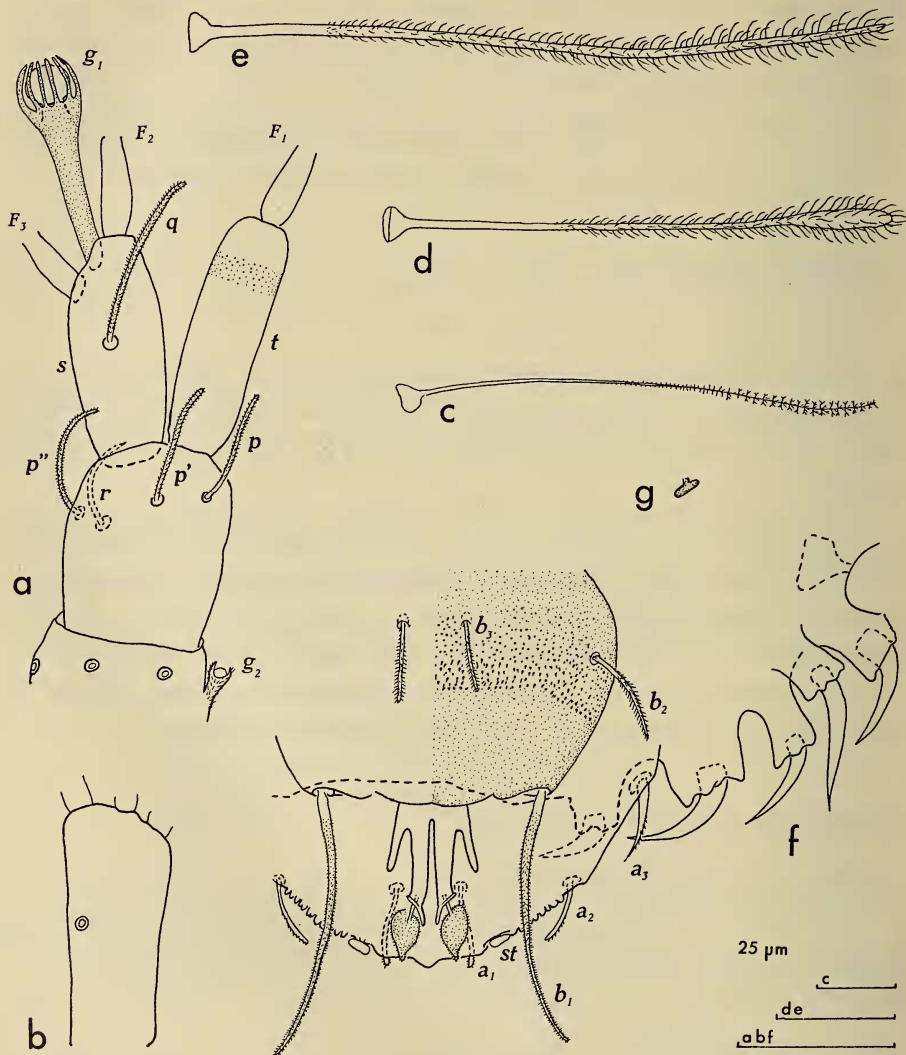


FIG. 1.

Gravieripus cordatus n.sp. — *a*, right antenna, ventral view. — *b*, sternal branch of left antenna, ventral view (paratype specimen). — *c*, T_2 . — *d*, T_3 . — *e*, T_4 . — *f*, pygidium, ventral view. — *g*, *st.* — Pubescence only partially drawn in *a* and *f*.

(64-) 73-78 (-84), $u = 9-10$. These setae are thin, cylindrical, pubescent; first three of them and u blunt, r a little pointed. No p''' . The seta u is hidden on the tergal side very near to the base of t and has been studied only in some paratype specimens. Tergal seta p reaches (0.4-) 0.5 (-0.6) of length of tergal branch t . The latter (3.4-) 3.5 (-3.8) times as long as wide and (as long as or) slightly longer than sternal branch s . The latter branch, the posterodistal part of which is truncate, is subcylindrical, widest distally and (2.1) 2.2 (-2.4) times as long as wide. Its seta q is thin, cylindrical, pubescent; it is inserted in the middle of the branch and is (0.7-) 0.8 of the length of the branch itself. The t , s and g are faintly granular. Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, base segment = 12 (-13); $F_2 = (79-)$ 91, base segment (10-) 14; $F_3 = (62-)$ 72, base segment (9-) 10. The F_1 (2.9-) 3.0 (-3.3) times as long as t , F_2 is (2.5-) 2.8 and F_3 (1.9-) 2.2 times as long as s . The g (3.4-) 3.5 (-3.8) times as long as wide with an almost cylindrical stalk; diameter of globulus (0.8-) 0.9 of diameter of t .

Trunk. The tergites have many short, semicircular, conical tubercles projecting into the cuticle and pushing it up so that the tergite surface becomes strongly coarse. These projections are most frequent anteriorly but they are small there. Tergites also set with many spines of various shapes, marginal ones of anterior corners long, pointed, straight or almost straight; more posteriorly ones are shorter and sickle-shaped; those of inner surface are winged. The latter are short, slightly lanceolate; on each side they have large wings which are flat and horizontal, roundly triangular and transparent. The 2nd-6th tergites are nonsetose anterior of a dense and almost straight row of such spines. On 6th tergite the anterior row has 7-8 (-9) winged spines. All winged spines project posteriorly from the hind part of an oval flat-bottomed and shallow depression in the cuticle; this depression is about twice as long as the spine itself. Relative lengths of tactile setae: $T_1 = 100$, $T_2 = (84-)$ 89 (-95), $T_3 = 56$ (-72), $T_4 = (84-)$ 90 (-93), $T_5 = 83$ (-98). These setae simple, pubescent. The T_1 and T_2 , which are much thinner than the others, are glabrous in proximal third and then with a delicate, erect, sparse pubescence which is gradually lengthening distally and also ramose. The T_3 with a thick axis and an apical end-swelling which is about 5 times as long as wide; pubescence rather strong, a little depressed, with simple hairs which are longest on the end-swelling. The T_4 and T_5 similar to T_3 but the end-swelling is lacking (almost lacking in the Turkey specimens) and the distal pubescence a little longer.

All legs 5-jointed. Seta of trochanter of 9th pair of legs furcate, shortly pubescent; main branch strongly pointed; secondary branch cylindrical, reaching almost 0.3 of the length of seta. Seta of trochanter of 8th pair of legs and those more anteriorly with cylindrical, shortly pubescent main branch and cylindrical, glabrous secondary branch which has a short apical hair. Seta of coxa of 9th pair of legs thick, conical, about 3 times as long as wide, pointed, shortly pubescent.

Tarsus of 9th pair of legs 2.5 (-2.7) times as long as its greatest diameter. It has 3 setae, 2 tergally and one sternally, all pointed, glabrous. Proximal tergal

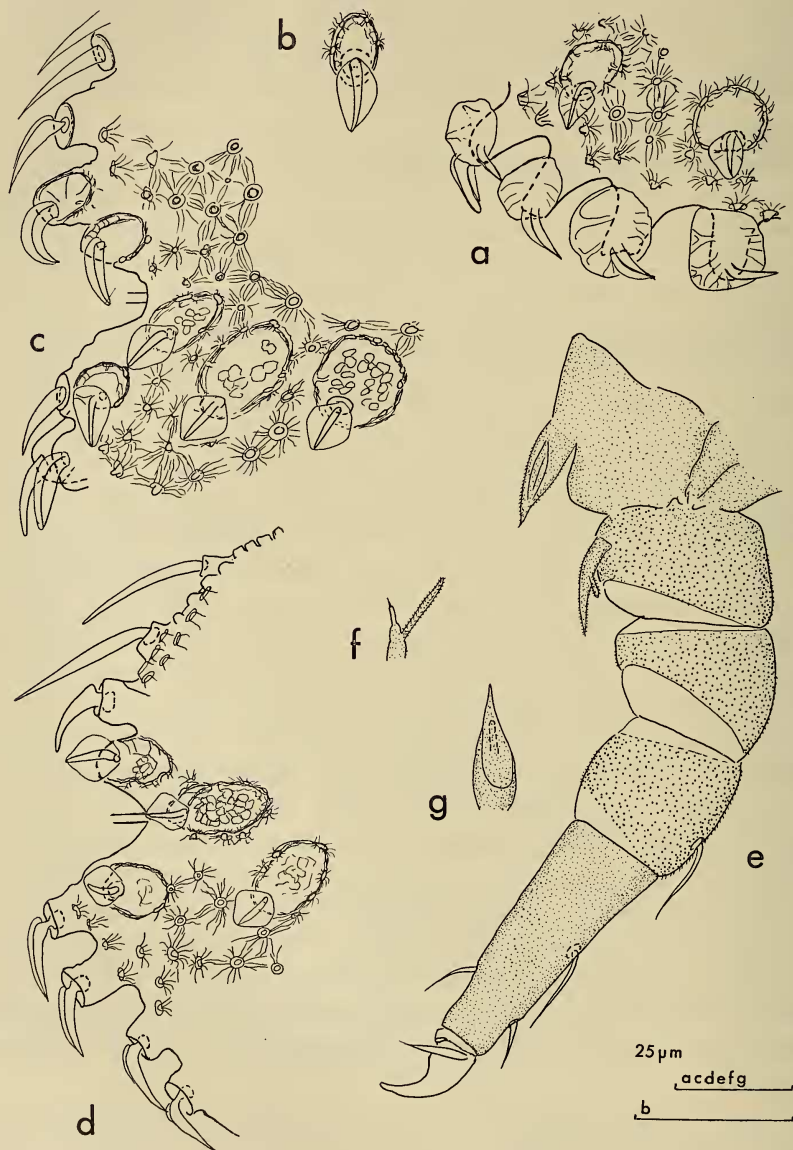


FIG. 2.

Gravieripus cordatus n.sp. — a, 2nd tergite, left posterior corner. — b, winged spine with insertion area, 2nd tergite, central part, dorsal view. — c, 4th tergite, left side with insertion area of T_3 . — d, 6th tergite, left posterior corner with insertion area of T_5 . — e, 9th leg, anterior view. — f, seta of trochanter of 8th leg. — g, seta of coxa of 8th leg.

seta longest, (0.3-) 0.4 of the length of tarsus; it is (1.3-) 1.7 times as long as distal sternal seta and (1.4-) 1.9 times as long as distal tergal seta. Main claw robust with broad base, 1.5 (-1.6) times as long as the secondary claw. Cuticle of legs granular or very shortly pubescent.

Pygidium. Tergum. Posterior margin rounded but with a small postero-median lobe. Relative lengths of setae: $a_1 = 100$, $a_2 = 85$ (-100), $a_3 = 140$ (-168), $st = (15-)$ 19. The first two are subequal, thin, cylindrical, blunt; a_1 slightly diverging, a_2 converging. The a_3 spinous, strongly pointed, slightly converging. The a_1 shortly pubescent, a_2 and a_3 with a few hairs on posterodistal half. The st are very short, sunk in the pygidial cuticle, fungiform with the cap thickest towards the middle of tergum. Distance a_1-a_1 (0.7-) 0.8 (-1.1) of length of a_1 ; distance a_1-a_2 (1.1-) 1.3 times as long as distance a_2-a_3 ; distance $st-st$ 9.1 (-11.5) times as long as st and (2.1-) 2.3 (-2.5) times as long as distance a_1-a_1 .

Sternum. The posterior lobe between the b_1 is very low and only slightly indentated in median part. Cuticle pubescent, most coarse just posterior of b_2 and b_3 . Relative lengths of setae ($a_1 = 100$): $b_1 = (304-)$ 324 (-361), $b_2 = (137-)$ 138 (-158), $b_3 = 95-108$ (-126). All these setae are subcylindrical, a little pointed, pubescent. The b_1 thickest proximally and with erect pubescence, b_2 and b_3 more evenly cylindrical with slightly depressed pubescence. The b_1 and b_2 are diverging. The latter (1.1-) 1.2 times as long as distance b_1-b_1 ; b_2 (0.7-) 0.8 of distance b_1-b_2 ; b_3 inserted anterior of b_2 ; b_3 as long as to 1.2 (-1.6) times as long as distance b_3-b_3 . Anal plate lyrate with 4 posterior appendages: lateral ones slightly diverging, blunt, glabrous, short, about one fourth of total length of plate; submedian ones long, straight, distally oblique with an inner pubescent finger-like lengthening projecting posteriorly. From the oblique and somewhat excavated ends arise two leaf-like, heart-shaped, pubescent appendages with thin and glabrous stalks. Length of appendages (including stalks) one third of total length of plate which is (0.7-) 0.8 of distance b_1-b_1 .

Affinities. Because of many characters of the antennae, tergites and pygidium the new species has to be placed in the proximity of *latzeli* and *atticus*. It is distinguished from them in many respects, e.g.: the globulus of the fourth antennal segment is much shorter, the setae of the pygidium and the distal appendages of the submedian branches of the anal plate and the tergite setae are of dissimilar shapes. *G. cordatus* is related also to *asper* n.sp. and *hispanicus* n.sp. but they can not be confused. Useful separating characters are offered by the shape of the tergal and pygidial setae and the anal plates.

The new species has also much in common with *Trachypauropus glomerioides* Tömösváry. They are quite identical or at least very similar as to many characters and disregarding the different leg-segmentation they seem to be close.

Distribution. Spain, Gerona Prov., La Junquera, at bases of ferns, 6 ad. 9 (♀♀), 1 subad. 8 (♀), 1966-10-01, leg. Comellini. — Turkey, near Istanbul, Belgrade forest, 2 ad. 9 (♀♀), 1967-06-04, (Loc. 54), leg. Besuchet.

5. *Gravieripus asper* n. sp. (figs. 3-5)

Material examined. 3 specimens.

Holotype. The adult female from Wiesbaden in West-Germany. Data: See below under Distribution.

Colour. Dark brown.

Length. 1.32 (-1.38) mm. Greatest breadth (3rd tergite) (0.49-) 0.58 mm.

Antennae. Globulus g_2 of tergal side of 3rd joint twice longer than broad; it has a short pubescence. Relative lengths of setae of 4th joint: $p = 100$, $p' = (95-)$ 107, $p'' = (70-)$ 83, $p''' = (41-)$ 46, $r = (50-)$ 60. These setae are cylindrical, feebly striated, shortly pubescent; the r is pointed, the others blunt. No u . Tergal seta p reaches 0.5 (-0.6) of length of tergal branch t . The latter is cylindrical, (3.8-) 4.4 times as long as wide and it is a little shorter than sternal branch s . The latter branch, the posterodistal part of which is truncate, is subcylindrical, (2.9-) 3.0 times as long as wide. Its seta q is thin, cylindrical, pubescent, slowly tapering towards distal end; it is inserted one third from the proximal end of s and reaches 0.7 (-0.8) of the length of the branch itself. The t and s are faintly granular. Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, base segment = (14-) 15; $F_2 = 90$ (-93), base segment = 11 (-12); $F_3 = (63-)$ 65 (-66), base segment = 8 (-9). The F_1 2.7 (-2.9) times as long as t , F_2 is 2.3 (-2.5) and F_3 1.7 (-1.8) times as long as s . Globulus g long-stalked, 5.0 (-5.2) times as long as wide and with about 10 bracts; stalk faintly granular, bracts shortly pubescent; diameter of globulus almost 0.6 of diameter of t .

Trunk. Tergite surfaces ornamented with small round nonsetose tubercles which are placed irregularly and are rare or absent near the margins which are very finely serrate. Tubercles partly arranged in circles having only a few tubercles inside. Tergites also set with large leaf-like or fungiform, unsymmetrical, glabrous protuberances about twice as long as broad; they are inserted irregularly except on the lateral and hind margins where they are projecting regularly like large teeth. They are most frequent on anterior tergites, on the 5th one there are only 4 rows lengthways, on 6th tergite only 4 inner protuberances. Tergites partly clear of them, particularly most anteriorly and in round areas just anterior of posterior margins. Anterior protuberances much smaller than posterior ones. Lateromarginal ones on 6th tergite long and leaf-like. Relative lengths of tactile setae: $T_1 = 100$, $T_2 = (95-)$ c. 100, $T_3 = (53-)$ 55, $T_4 = (93-)$ 97, $T_5 = (94-)$ 98.

These setae except T_3 with thin axes tapering distally. The T_3 with a thicker axis and a longish, distal, slightly pointed enlargement about 4 times as long as its greatest diameter. Pubescence of these setae very short, simple, arranged in whorls.

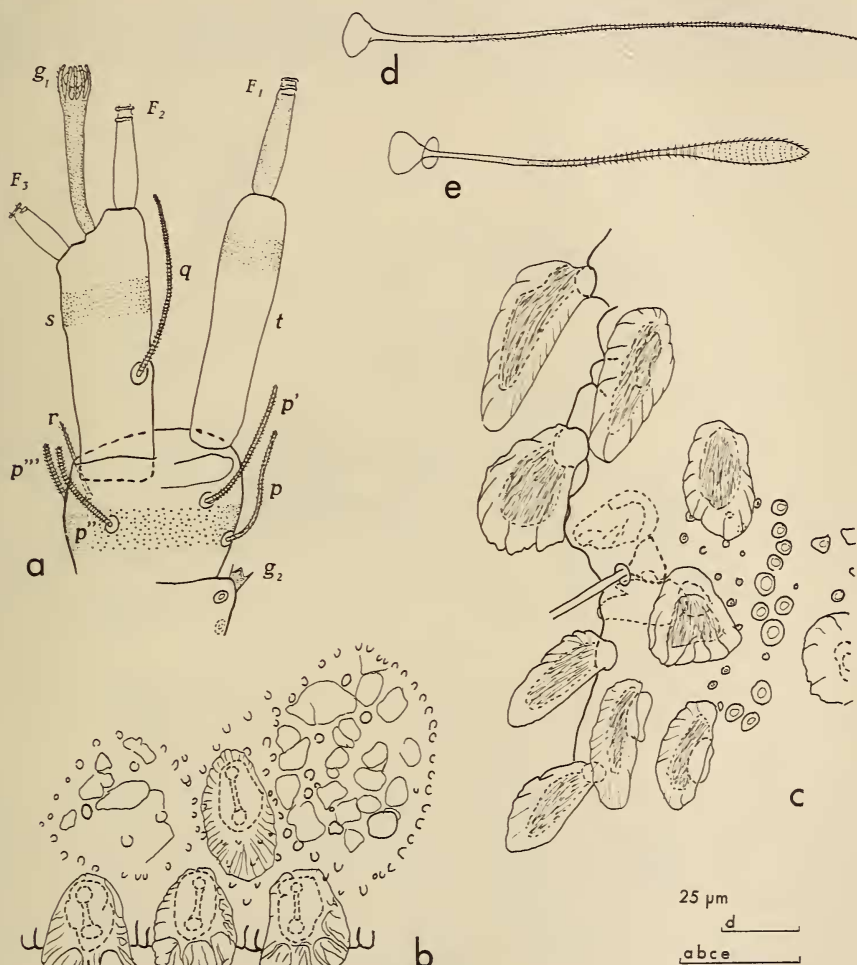


FIG. 3.

Gravieripus asper n.sp., holotype. — *a*, right antenna, ventral view. — *b*, 2nd tergite, hind margin. — *c*, 4th tergite, left side with insertion area of T_3 . — *d*, T_1 . — *e*, T_3 . — Pubescence only partially drawn in *a*.

All legs 5-jointed. Seta of trochanter of 9th pair of legs furcate, pubescent: main branch cylindrical, blunt, half of the length of seta; secondary branch shorter, pointed. Seta of coxa not studied in detail. Seta of trochanter of 8th pair of legs with pubescent base and pubescent, pointed main branch which length

is 0.8 of the length of seta; secondary branch shorter, pointed, glabrous. Seta of coxa of 8th pair with thick, almost cylindrical, blunt, pubescent main branch and thin, shorter, pointed, glabrous secondary branch. In anterior legs these setae are similar to those of 8th pair of legs.

Tarsus of 9th pair of legs 2.5 (-2.7) times as long as its greatest diameter. It has three pointed, glabrous setae, one proximal and two distal ones. Proximal

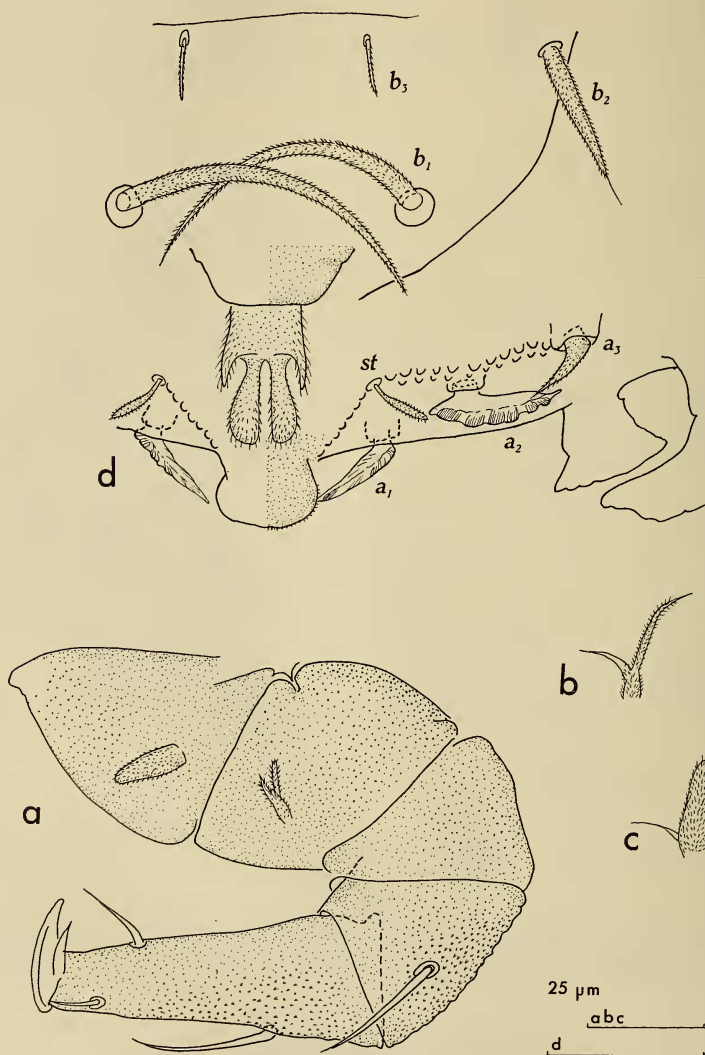


FIG. 4.

Gravieripus asper n.sp., holotype. — a, 9th leg, anterior view. — b, seta of trochanter of 8th leg. — c, seta of coxa of 8th leg. — d, pygidium, ventral view. — Pubescence only partially drawn in d.

seta long, 0.4 of the length of tarsus and (2.1-) 3.1 and (1.5-) 1.7 times as long as upper distal and lower distal seta respectively. Seta of tibia pointed, 0.7 of the length of joint. Main claw robust, 2.2 times as long as the slender secondary claw.

Pygidium. Tergum. Posterior margin rounded except in its median part of ventral side which has a large triangular posterior projection with the base between the styli and with distal part widened, oval. Relative lengths of setae: $a_1 = 100$,

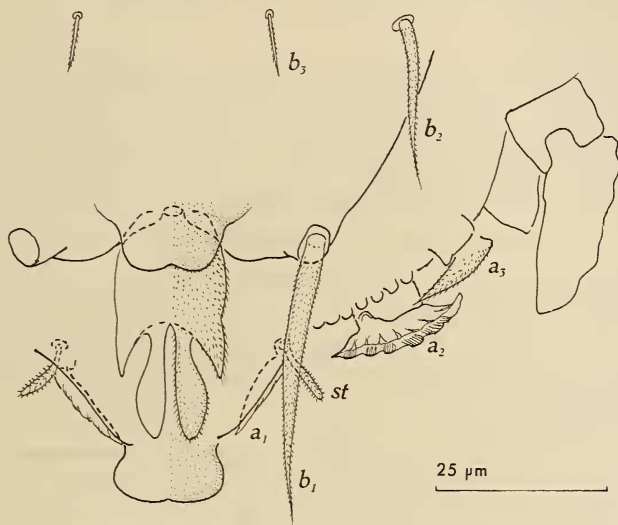


FIG. 5.

Gravieripus asper n.sp., paratype, ad. (♀) from Genève, Vernier.
Pygidium, ventral view. — Pubescence only partially drawn.

$a_2 = 136$ (-150), $a_3 = 95$ (-112), $st = 65$ (-68). The a_1 are somewhat lanceolate, thick-stalked and with a rough surface and slightly undulating edges; they are glabrous, converging. The st feebly clavate, shortly pubescent, strongly diverging. The a_2 are unsymmetrical, robust, glabrous scales with short, thick, cylindrical stalks and undulating margins. The a_3 are claw-like, spinous, with thick bases and strongly pointed distal parts. They are directed inwards perpendicularly to the thick cylindrical stalk. Distance a_1 - a_1 2.1 (-2.4) times as long as a_1 ; distance a_1 - a_2 about as long as distance a_2 - a_3 ; distance st - st 3.3 (-3.4) times as long as st and about as long as distance a_1 - a_1 .

Sternum. Relative lengths of setae ($a_1 = 100$): $b_1 = 324$ (-375), $b_2 = 178$ (-205), $b_3 = 68$ (-84). The b_1 spinous, converging, curved, evenly tapering towards distal end, strongly pointed and with a distal hair; b_2 almost as b_1 , diverging, rather thick, pointed and with a distal hair, b_3 almost cylindrical, pointed. All these setae with a delicate short pubescence. The b_1 1.1 (-1.2) times

as long as distance b_1-b_1 ; b_2 (0.8-) 0.9 of distance b_1-b_2 ; b_3 inserted on a level with the b_2 , they are 0.3 (-0.4) of distance b_3-b_3 . Anal plate subsquare (to rounded), narrowest at the base and with 4 appendages projecting posteriorly from the hind margin. Two of them are submedian, large, clavate but with straight inner margins; the other two are conical posterior lengthenings of the hind corners. Plate and its appendages pubescent, strongest on lateral margins of plate and distal parts of submedian appendages. Length of plate 0.6 (-0.8) of distance b_1-b_1 .

Affinities. *G. asper* is well defined on the whole, particularly in its peculiar protuberances of the tergites, the shape of the pygidial setae and the structure of the anal plate. It seems to be most close to *hispanicus* n.sp. which is described below but is easily distinguished from that species in many pygidial characters. It differs from the pair *latzeli* and *atticus* in many respects e.g. in the quite dissimilar shape of the large protuberances on the tergites and in the differences of the pygidial setae and the anal plates. It is also different as to a few antennal characters and the shape and the pubescence of the third pair of tactile setae. The characters separating it from *armatus* are also easily distinguishable since the latter has no apical widening on the third pair of tactile setae, thin pygidial setae and a quite individual anal plate.

Distribution. West-Germany (BRD), Wiesbaden, Adamstal, from ground water filtration, 1 ad. 9 (♀), 1964-08-11, (Loc. Wi/Ad/II), leg. Husmann. — Switzerland, Geneva, Vernier, at the base of a poplar, water flotation, 2 ad. 9 (♀♀), 1961-11-15, leg. Besuchet and Comellini.

6. *Gravieripus hispanicus* n. sp. (figs. 6-7)

Material examined. 1 specimen.

Holotype. The single adult specimen known. Data: See below under Distribution. The type specimen is in the collections of the Natural History Museum, Geneva.

Colour. Brown.

Length. 1.33 mm. Greatest breadth (3rd tergite) 0.41 mm.

Antennae. Globulus g_2 of tergal side of 3rd joint subcylindrical, 1.6 times as long as broad; its cuticle is faintly granular. Relative lengths of setae of 4th joint: $p = 100$, $p' = 93$, $p'' = 82$, $r = 48$. These setae are thin, cylindrical, blunt, pubescent. No p''' . Tergal seta p reaches almost 0.5 of length of tergal branch t . The latter is cylindrical, 4.5 times as long as wide and it is of the same length as sternal branch s . The latter branch, the posterodistal part of which is truncate, is subcylindrical and 2.7 times as long as wide. Its seta q is thin, cylindrical,

whorled; it is inserted in the middle of the branch and is 0.7 of the length of the branch itself. The *t* and *s* are faintly granular. Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, base segment = 14; $F_2 = 89$,

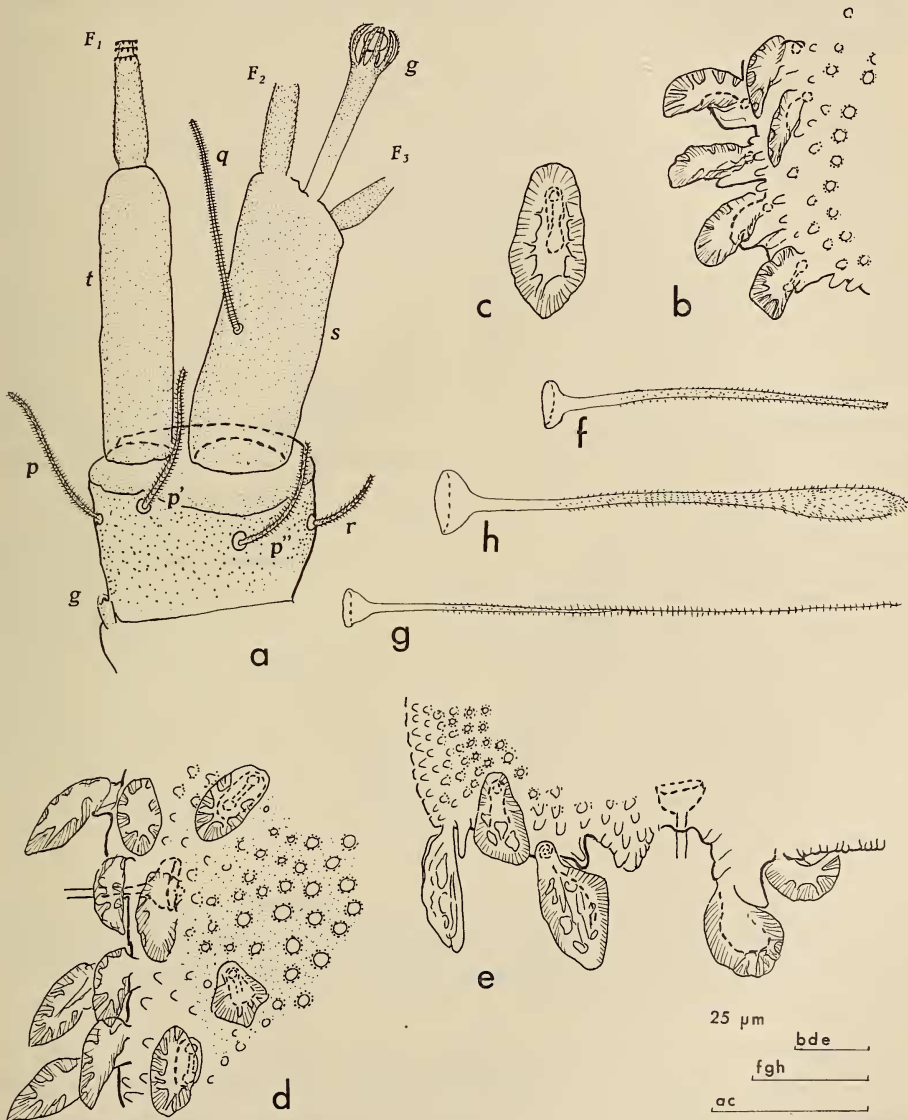


FIG. 6.

Gravieripus hispanicus n.sp. — *a*, right antenna, ventral view. — *b*, 2nd tergite, left posterior corner. — *c*, leaf-like protuberance from central part of 2nd tergite, dorsal view. — *d*, 4th tergite, left side with insertion area of T_3 . — *e*, 6th tergite, left posterior corner with insertion area of T_5 . — *f*, T_1 . — *g*, T_2 . — *h*, T_3 .

base segment = 12; $F_3 = 71$, base segment = 9. The F_1 2.6 times as long as t , F_2 is 2.3 and F_3 1.8 times as long as s . Globulus g 3.9 times as long as wide with a cylindrical stalk and pubescent bracts; diameter of g 0.7 of diameter of t . The t and s , the base segments of the flagella and the stalk of the globulus are faintly pubescent.

Trunk. Tergite surfaces covered with many small nonsetose tubercles which are placed irregularly and are growing very small towards the anterior margins; tubercles largest on inner parts of tergites. The latter also set with large leaf-like or fungiform unsymmetrical protuberances about twice as long as broad. They are projecting regularly like teeth from lateral and posterior margins and are also common on posterior third of tergites. Inner protuberances most frequent on anterior tergites; on the 5th one there are only 4 rows lengthways; on the following only 4 individual protuberances. Lateral protuberances longer and more leaf-like than the others. Relative lengths of tactile setae: $T_1 = 100$, $T_2 = 164$, $T_3 = 101$, $T_4 = 194$, T_5 broken. These setae simple with short pubescence; T_1 rather thick, subcylindrical; T_2 and T_4 thin, tapering and with erect pubescence. The T_3 with a thick axis and a distal, longish, blunt enlargement; pubescence of this seta verticillate in the middle third; end-swelling about 3.8 times as long as wide.

All legs 5-jointed. Seta of trochanter of 9th pair of legs furcate, pubescent; both branches cylindrical, each with a thin apical hair almost half of the length of the branch. Seta of coxa furcate, glabrous. Seta of trochanter of 8th pair of legs with base and main branch pubescent; secondary branch glabrous, almost 0.5 of the length of main branch which is 0.6 of the length of seta. Seta of coxa of 8th pair of legs furcate, glabrous with very pointed branches; main branch conical, much longer than the thin secondary branch. In anterior legs these setae are similar to those of 8th and 9th pair of legs. On first pair of legs the main branch of the coxal seta is faintly pubescent and the seta of trochanter has two branches of subequal length, one cylindrical, strongly pubescent, the other almost hair-like, glabrous.

Tarsus of 9th pair of legs 2.5 times as long as its greatest diameter. Its setae are pointed, glabrous. Proximal seta longest, 0.4 of the length of tarsus and 1.3 times as long as upper and lower distal setae. Seta of tibia pointed, almost 0.7 of the length of joint. Main claw robust, 1.7 times as long as the secondary claw.

Pygidium. Tergum. Posterior margin evenly rounded except in its median part of ventral side which has a posterior, rounded projection. Relative lengths of setae: $a_1 = 100$, a_2 (height) = 70-74, $a_3 = 104$ -106, $st = 80$. The a_1 and a_3 are equal, spinous, with thick bases and strongly pointed distally, glabrous, converging. The a_2 are unsymmetrically fungiform with undulated margins; they are glabrous and have short, thick, cylindrical stalks. The st are a little clavate, blunt, pubescent, diverging. Distance a_1 - a_1 2.8 times as long as a_1 ; distance

a_1-a_2 1.3 times as long as distance a_2-a_3 ; distance $st-st$ 3.0 times as long as st and 0.8 of distance a_1-a_1 .

Sternum. Between the b_1 there is a large concavity on tergal side but a distinct rounded projection on sternal side, the latter with a median shallow indentation. Cuticle granular, most coarse between the b_3 . Relative lengths of

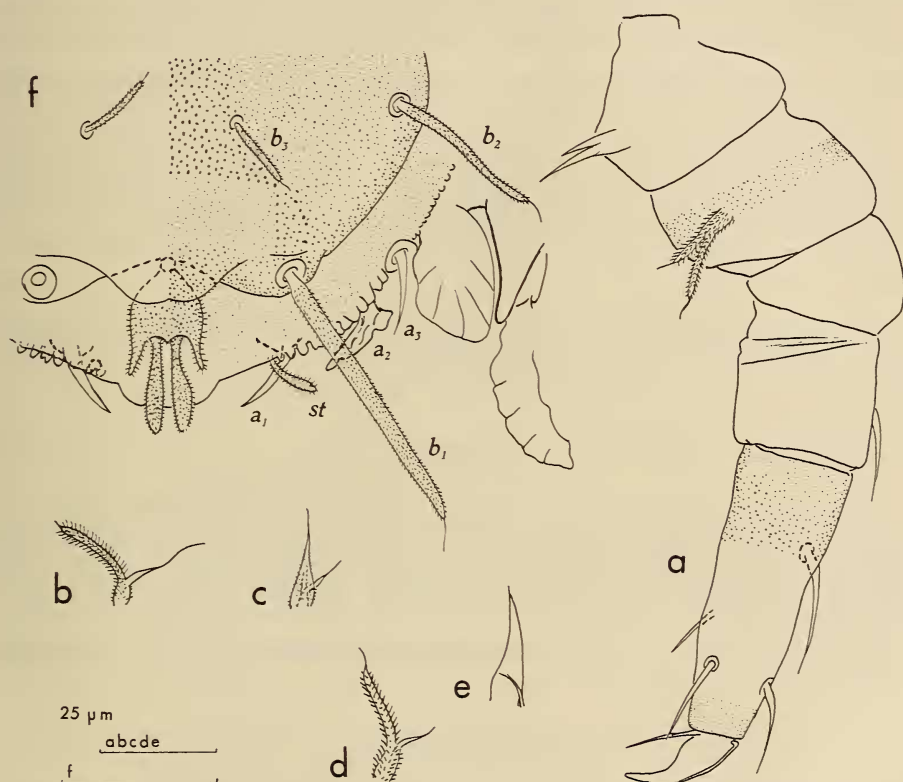


FIG. 7.

Gravieripus hispanicus n.sp. — *a*, 9th leg, inner-anterior view. — *b*, seta of trochanter of 1st leg. — *c*, seta of coxa of 1st leg. — *d*, seta of trochanter of 8th leg. — *e*, seta of coxa of 8th leg. — *f*, pygidium, ventral view. — Pubescence only partially drawn in *a* and *f*.

setae ($a_1 = 100$): $b_1 = 417-420$, $b_2 = 253-256$, $b_3 = 100-102$. All these setae are subcylindrical, pointed, with a distinct apical hair, pubescent. The b_1 and b_2 diverging, the latter proportionately thick. The b_1 1.2 times as long as distance b_1-b_1 ; b_2 0.9 of distance b_1-b_2 ; b_3 inserted on a level with the b_2 , they are 0.5 of distance b_3-b_3 . Anal plate lyrate, narrow at the base and with 4 appendages projecting posteriorly. The two submedian ones are long, clavate, blunt; the lateral ones shorter, 0.5 of the length of submedian ones, tapering, slightly

diverging. There is a short, median, triangular projection between the lateral appendages. Plate and appendages densely pubescent. Length of plate 0.7 of distance b_1-b_1 .

Affinities. The new species is well defined particularly in its peculiar cuticular protuberances on the tergites, the diversiform pygidial setae and in the structure of the anal plate. It is most close to *latzeli* and *atticus*, two species which resemble each other very much and which might have diverged by speciation from a common ancestry and subsequently evolved in parallel. *G. hispanicus* differs from them e.g. in having quite dissimilar large protuberances on the tergites, in the shape of the pygidial setae and in the structure of the anal plate. The characters separating it from *armatus* are distinct too, since the latter has no apical widening on the third pair of tactile setae, spinous tergal setae and thin pygidial ones and also since its anal plate has a posteromedian incision and only two posterior appendages.

Distribution. Spain, Gerona Prov., near Olot, Uria, 700 m a.s., at basis of an oak, 1 ad. 9 (♂), 1969-04-27, leg. Comellini.

ABSTRACT

The genus *Gravieripus* (Myriapoda, Pauropoda, Eurypauropodidae) is presented and its status is discussed from taxonomical points of view. It has long been considered to be very poor in species but a study of some specimens from Spain, Turkey, Switzerland and Germany has revealed three new species which are described. A key to the species of the genus has been constructed.

ZUSAMMENFASSUNG

Die Gattung *Gravieripus* (Myriapoda, Pauropoda, Eurypauropodidae) wird vom taxonomischen Standpunkt aus bearbeitet. Sie wurde lange als sehr artenarm angesehen, jedoch das Studium von einigen Exemplaren aus Spanien, Türkei, Schweiz und Deutschland ergab drei neue Arten, die beschrieben werden. Ein Schlüssel für alle Arten der Gattung wird gegeben.

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